Dietary preferences of captive Eastern Long-necked Turtles *Chelodina longicollis*

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Abstract

Fifteen adult Eastern Long-necked Turtles *Chelodina longicollis* (13 males, 2 females) were removed from billabongs located within the Ovens River floodplain, Victoria, during the summer of 1997/98 to examine their feeding preference in captivity, away from competitors, in a controlled environment. Four prey items were presented to the captive turtles: naucorids (Family Naucoridae), corixids (Family Corixidae), gudgeons *(Hypseleotris klunzingeri)* and caddisfly larvae (Family Leptoceridae). In total, 12.9% of prey was consumed without any dietary preference shown by turtles. It was concluded that turtles in captivity fed passively and opportunistically. Clearly, this may differ from their foraging strategy in the wild where the anti-predator behaviour of prey can differ greatly in the presence of refugia in a much larger and more complex habitat. (*The Victorian Naturalist* **124** (3), 2007, 163-166).

Introduction

Eastern Long-necked Turtles *Chelodina longicollis*, Broad-shelled River Turtles *C. expansa* and Murray Turtles *Emydura macquarii* in the Murray-Darling Basin exhibit habitat overlap and compete for prey. This is the case especially with the carnivorous, long-necked species, *Chelodina longicollis* and *C. expansa* (see Meathrel *et al.* 2002, 2004 and references therein). The sympatric Murray Turtle has a shorter neck, is omnivorous, grazes on periphyton, scavenges carrion and supplements its diet with aquatic insects and fish carrion to meet metabolic requirements (Chessman 1986; Spencer *et al.* 1998). *Chelodina longicollis* uses highly productive, ephemeral water bodies more often than the other two species (Chessman 1988), thereby lessening inter-specific competition (Kennett and Georges 1990).

One of the major challenges for wildlife ecologists is understanding how wild organisms perceive their environment and how that environment might be measured – the abundance and availability of prey, the level of inter- and intra-specific competition, etc. For freshwater turtles, the research relating habitat complexity with habitat selection and dietary partitioning is scarce. This study, therefore, examined the dietary preferences of *C. longicollis* under controlled laboratory conditions away from variable environments and competition.

Methods

Determination of the prey preference in captivity of *Chelodina longicollis* formed part of a larger study on the habitat preference and feeding ecology of freshwater turtles in billabongs in northeast Victoria (see Meathrel *et al.* 2004). Permission was obtained from the Victorian Department of Natural Resources and Environment (permit RP-97-170) and La Trobe University Animal Experimentation Ethics Committee (permit LSB96/24/V2) to place into short-term captivity (i.e. a period not to exceed three weeks) 15 adults of the most commonly encountered species *Chelodina longicollis* [13 males and 2 females, sexing followed Chessman (1978)] from the Ovens River floodplain (146°14'44" E, 36°14'05"S) between October 1997 and February 1998.

Laboratory housing consisted of 1.2 x 0.6 x 0.6 m fish tanks held at 22°C (i.e. the average temperature of water in the billabongs, unpublished data) and filled to 2/3 capacity and containing charcoal and fiberglass water filters to maintain water quality. No substratum (i.e. gravel, vegetation) was included in the tanks as this facilitated the quantification of prey items remaining following each trial. All turtles were in good health and allowed to habituate in individual tanks for 1 week prior to the commencement of feeding trials. They received food once every 24 hours for this period, but not within 24 hours of the feeding trials.

Prey offered were chosen on the basis of that which was common in the stomach contents of turtles examined in the field (Meathrel *et al.* 2004). Naucorids (Naucoridae) were collected from the Doctor's Point billabong in Albury, New South Wales; whereas corixids (Corixidae), gudgeons *(Hypseleotris klunzingeri)* and caddisfly larvae (Leptoceridae) were collected from a man-made lake located on the Wodonga grounds of La Trobe University. The amount of each prey type collected was variable. Hence, we were unable to replicate trials by presenting equal numbers of each prey type to each turtle for each of their two feeding preference trials.

For each experimental feeding trial, each turtle was presented with a range of prey items, totalling 40 to 60 individual prey items each trial. The turtles were then allowed 48 hours to consume prey (a procedure modified from Serrouya *et al.* 1995). After this time the turtles were removed and the tanks cleared of any remaining prey. These prey were counted and any missing items were assumed to have been eaten by the turtles.

At the completion of the first feeding trial, turtles were placed back into their individual tanks and starved for 24 hours to increase their appetite prior to presentation of a second group of prey (Serrouya *et al.* 1995). At the completion of all 30 feeding trials all turtles were released at their point of capture. No turtle was held in captivity for more than two weeks in order to meet the requirements of the animal ethics permit.

Data were analysed with the statistical package SPSS for Windows v. 12 using univariate ANOVA (Sokal and Rohlf 1995) comparing the preference of the turtles for different prey types. As we could not offer turtles the same number of each different prey type in both experimental feeding trials, we converted the data to the proportion of prey eaten out of all prey offered (i.e. preference).

Results

Of the total 1232 prey items offered to the 15 *Chelodina longicollis*, 159 (12.9%) were consumed (Table 1). Prey preference, measured as the number eaten out of the number offered, did not differ between each turtle's two separate feeding trials ($F_{1,113} = 0.023$, $p>0.05$) and these data were combined. Prey preference did not differ between the various types of prey fed to turtles in the laboratory ($F_{3,113} = 0.532$, $p>0.05$) and suggested that the 15 *Chelodina longicollis* in captivity were non-selective foragers (Fig. 1). Statistical comparison of prey preference between the genders was not warranted because the data from only two females could not be validly tested against that of 13 males. However, it appeared that there was little difference in prey preference between male and female turtles. Generally, males ate a greater proportion of prey offered, but this may have been caused by males 4, 9 and 10 (Table 1) all of which ate approximately 35% of the prey offered as compared to just 5% for the other turtles.

Discussion

Long-held ecological principles of habitat use and foraging strategies suggest that organisms use optimality decision rules (= fitness maximising) to respond to changes in their feeding environment (Pyke *et al.* 1977; Chesson 1983). Changes can arise from extrinsic, environmental factors such as annual and seasonal variation in prey abundance and availability, exacerbated by the presence of competitors for the food resource, thereby rendering the study of an organism's preferred diet difficult. Hence, in this study 15 *Chelodina longicollis* were taken into the laboratory in an attempt to control for such change in order to simplify the detection of the potential existence of prey preference in this species of freshwater turtle.

The prey types and their relative proportions offered to the captive turtles in this study were the same as those gathered for a reference collection of aquatic fauna for the billabongs at Killawarra (Meathrel *et al.* 2004). The presence of these types of prey within the guts of wild turtles merely may have represented the preys' availability and accessibility rather than any specific preference the turtles may have had for them in the wild. To determine whether captive turtles were feeding preferentially or opportunistically in this study, all prey items were presented to the turtles without refugia such as snags, macrophytes or tur-

Table 1. The number of prey offered and eaten by captive Eastern Long-necked Turtles in captivity; data combined for the two trials per individual. F = female, M = male.

Turtle	Prey type	Naurcorids	Corixids	Gudgeons	Caddisfly larvae
F - 1	# prey offered	26	40	9	20
	# prey eaten	0	2	0	0
F - 2	# prey offered	16	40	9	8
	# prey eaten	2	1	0	1
M - 1	# prey offered	25	40	10	24
	# prey eaten	1	1	0	2
M - 2	# prey offered	25	40	10	24
	# prey eaten	10	5	0	2
M - 3	# prey offered	15	40	15	9
	# prey eaten	0	1	0	5
M - 4	# prey offered	17	40	7	7
	# prey eaten	3	22	0	1
M - 5	# prey offered	16	40	7	7
	# prey eaten	1	1	0	0
M - 6	# prey offered	16	40	7	7
	# prey eaten	1	3	2	2
M - 7	# prey offered	15	40	14	5
	# prey eaten	1	1	0	2
M - 8	# prey offered	16	40	19	4
	# prey eaten	0	5	2	0
M - 9	# prey offered	20	40	26	9
	# prey eaten	10	0	21	2
M - 10	# prey offered	20	40	26	10
	# prey eaten	1	11	24	1
M - 11	# prey offered	20	40	21	10
	# prey eaten	0	4	0	0
M - 12	# prey offered	16	40	9	6
	# prey eaten	0	0	2	0
M - 13	# prey offered	16	40	8	6
	# prey eaten	3	0	0	0

bid water, and so were readily available for capture. No prey preferences were shown by the turtles which suggested that the turtles were passive, opportunistic feeders. Chessman (1978, 1984) and Georges *et al.* (1986) also made this assumption, but Onkonburi and Formanowicz (1997) cautioned that the distinction between passive and active prey preference may be altered by the interaction between forager behaviour and prey antipredator behaviour.

Meathrel *et al.* (2004) found that male and female turtles in the wild appeared to consume the same prey items. Given the disparate sample sizes between the two genders, no definitive statements were warranted in this study of turtles in captivity. The female turtles brought into captivity were approximately 15% larger and 40% heavier than males (unpubl. data), and therefore should have consumed more than males. However, the two females consumed less than the 13 males. In fact, low numbers (approx. 5%) of prey were consumed in the laboratory experiments, with turtles in some trials consuming nothing at all. This may have resulted from an insufficient habituation time due to permit restrictions. Although not observed, if subject to stress the turtles may have abstained from eating as they are capable of withstanding long periods with limited food supplies (Kennett and Georges 1990).

Although inferences of dietary preference in captivity can be applied only loosely to management of a species' natural habitat, managers of Australia's freshwater ecosystems should be aware that the level of 'pristine' habitat retained must not only meet the dietary metabolic requirements of species, but their ecological requirements as well. In the wild, with refugia and changing environmental conditions, more prey need to be retained to ensure that predators have the opportunity to encounter prey at levels sufficient to cover their

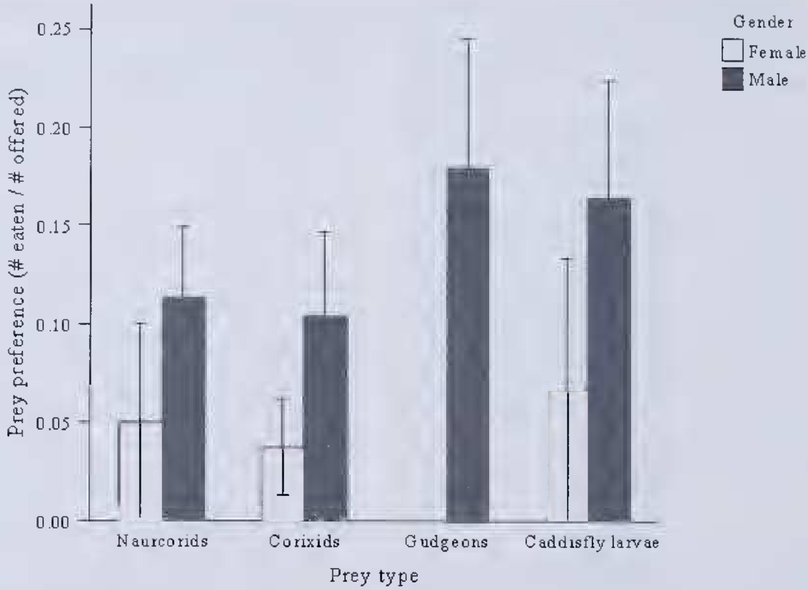

Fig. 1 Comparison of mean (± 1 standard error) prey preference for 2 female and 13 male adult *Chelodina longicollis* held in captivity.

metabolic requirements. Further research on the dietary preferences of Australia's freshwater turtles needs to explore how prey preference may change over many seasons and years.

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